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# APPENDIX A

Application for Provisional Patent

# CONDUCTIVE COUPLER WITH THREE DEGREES OF FREEDOM

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## CROSS-REFERENCES TO RELATED APPLICATIONS: TBD

## BACKGROUND & FIELD OF INVENTION:

Currently, a variety of mobile and portable devices, including laptop and portable computers, mobile telephones, pagers, personal digital assistants and other electronic devices must be connected to external electrical power sources that provide electrical power to the devices themselves, or, to recharge internal batteries of such devices, namely re-chargers. Access to these power sources, typically a plug-in cable, restrict the locations and mobility of such devices.

What is clearly needed is a better way to solve these problems by providing a power source that allows random placement and movement of the device without requiring plugging in a cable, cradle etc..

The field of the invention is that of power supplies and re-chargers interconnections for portable or mobile devices.

## DESCRIPTION OF THE INVENTION:

The invention describes an electrical coupling system ("CS") that allows the closing of an electrical circuit between two bodies, each with a surface that contains an electrical conductive area. The CS provides three degrees of freedom between the two surfaces, two as a linear movement or offset in the X and Y axis of a plane essentially co-planar to the larger of the bodies, and the third is a rotation around the Z axis perpendicular to that plane. Figure 1 shows a simplified isometric view of a CS consisting out of the conductive are marked "BASE" in the base unit, that is typically stationary, and a second conductive area marked "Adapter". Also shown for orientation is the above mentioned coordinate system, and wires marked "wires (adapter side)" and "wires (base side)" respectively. Those conductive areas may either be attached to the bodies, or in a preferably integrated into the body structure. This allows a circuit to be closed, with out requiring alignment, as is typically required by connectors, cradles etc.

In one instance, the Coupler may be used to power a laptop computers or other Devices that are placed freely on an energizing desktop or other surface forming the base. The desk or surface acts as one side of the coupler and the bottom of the Device acts as the second side. A power supply is connected to the active part of the desk or surface (such as a desk pad, writing pad etc.) and can close an electrical circuit with the active area of the device placed upon, allowing a charging circuit of the Device independent of the position and orientation or angle of the Device.

The CS is made of two surfaces, and each of the surfaces having at least two contacts. For convenience the stationary surface will be referred to as the "Base" and to the other as the "Adapter" but this choice of wording is arbitrary and does not imply any preferred embodiment or limit the possible embodiments of the present invention.

When the two surfaces are put together (typically the adapter on top of the base, their relative position can be expressed as a tuple of three numbers <X, Y, G> called the 'relative placement' or "Placement" in short. The X and Y values denote the linear displacement between the centers of the two surfaces in the X and Y axis respectively. The G value denotes the relative radial angle in degrees between the two surfaces as projected on the X,Y plane with some arbitrary relative rotation considered to be of zero degrees.

A Placement is said to be 'supported' or 'active' by an embodiment of the present invention if a closed electrical circuit can be formed between the Base and the Adapter through the contacts of the Base and the Adapter. In a preferred embodiment, the set of active Placement forms a continuous range without gaps but this characteristic depends on the application in which each embodiment is used.

Fig. 2 shows a simplified view of an adapter placed on a base, forming a CS t The Base and the Adapter surfaces each has at least two contacts whose count, sizes, shapes and spacing and arrangement are determined such that in each Placement that is the active range of the coupler, there is at least one pair of contacts A1 and A2 of the Base and at least one pair of contacts B1 and B2 of the Adapter such that

1. Contact A1 of the Base touches contact B1 of the Adapter;
2. Contact A2 of the Base touch contact B2 of the Adapter;
3. The contacts of the Base and the Adapter do not form a short circuit between A1 and A2.

A careful review of these conditions shows that when these conditions are met, a two-wire electric circuit can be formed between the Base and the Adapter using contacts A1-B1 as one lead and contacts A2-B2 and the other lead.

The routing of the current to the proper pair of contacts for each Placement can be done in many ways. In some embodiment, a sensing circuit detect a signal that is asserted by the Adapters to the Base contacts it touches and use this information to activate that Base contacts. In other embodiment the current can be redirected to the

proper contacts by sensing the relative position of the two surfaces and using a predefined formula to determine which Base contacts to activate. In other embodiment, the Base can switch the power to a sequence of pairs of Base contacts until it senses the proper circuit is closed with the device. In other embodiment, the current routing can be done by mechanical switches that are activated by the surfaces based on their relative location. In yet other cases a spacing pattern can be selected, by which due to the distance of the contacts on the adapter and on the base, always a correct correlation can be guaranteed, by using a checker board style pattern for the base, e.g. Fig. 2. Also shows a "power source" connected to the base, without showing the above mentioned switching mechanisms for simplicity.

Fig. 3 shows an example of how a CS for a notebook might be implemented.

In this case the Coupler provides a wide range of movement in the X and Y directions and a 360 degrees freedom of rotation around the Z axis. The Base is the top surface of a desktop, the Adaptor is built in into a notebook, and the Adapter contacts are mounted on the bottom surface of notebook. They could be built in some cases, or an actual adapter pad with contact areas may be attached to the bottom side of a regular notebook and a wire may connect the notebook's regular charging port. The Base contacts in this embodiment are arranged as an array of circle of radius R with horizontal and vertical spacing of D between any two adjacent contacts.

The Adapter in this example uses only two contacts, each is a circle of radius (R+D/2)*SQRT(2) and with a spacing of at least 2R.

A close examination of the design shows that in this embodiment, when the notebook is placed on the desktop at an arbitrary location and angle, two Base contacts A1 and A2 that satisfy the three conditions above can always be found. These two contacts can be used to close a circuit with the notebook through the two notebook contacts. It is clear that other spacing and contact sizes and placements may be used. For example, rather than just rows and columns, the base may have a honey-comb style interleaving arrangement, or long linear contacts etc.

Again, for help of understanding a "load" symbolizes the electric aspects of the notebook, and the "power source" that of a supply, which may be in some cases considerably more complex.

Figure 4 shows an example, in which the CS is simplified by eliminating the need to perform dynamic power switching to the Base contacts at the expense of providing a more limited active range of positions and rotational angles. The Base uses two large rectangular pads and the Base use two smaller round pads. This arrangement allows limited linear movement in the X and Y axis and limited rotational movement around the Z axis.

## CLAIMS:

1. A system for improving the connection between a mobile device and a power charger unit, consisting of a two substantially planar surfaces, each of those surfaces containing at least two contacts, wherein for closing the electric circuit all that is required is to set on surface in contact with the other without accurate alignment.

2. A method for improving the connection between a mobile device and a power charger unit, consisting of a two substantially planar surfaces, each of those surfaces containing at least two contacts, wherein for closing the electric circuit all that is required is i) to set on surface in contact with the other without accurate alignment.

**DRAWINGS:**

Figure 1:

FIGURE 1 THE THREE LEVELS OF FREEDOM

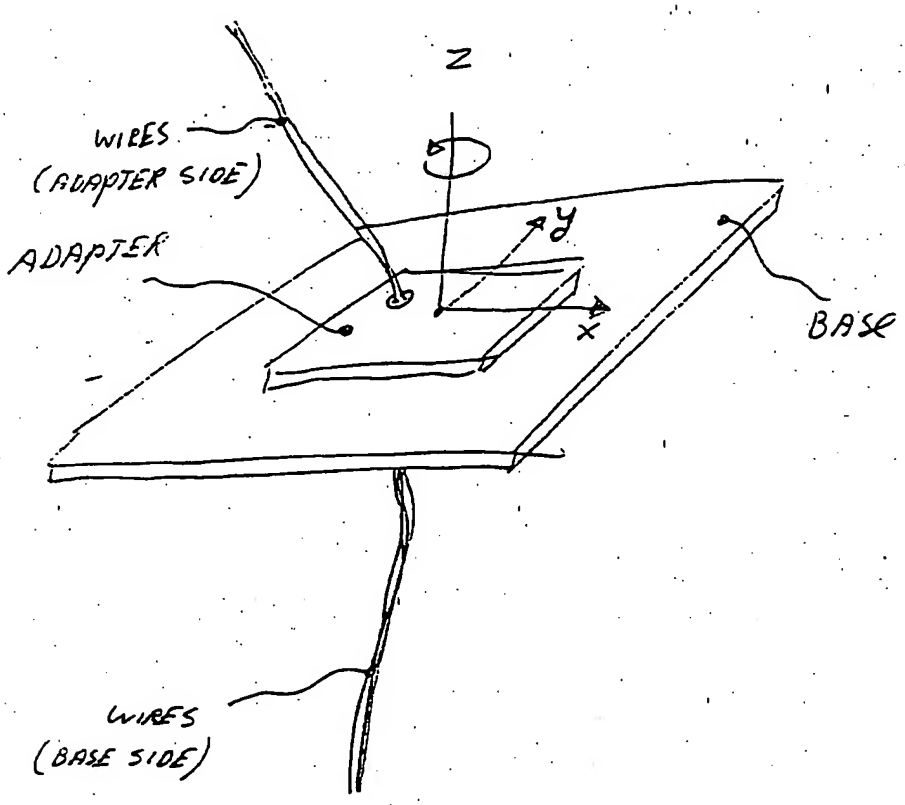


Figure 2:

FIGURE 2 - ACLOSE CIRCUIT THROUGH $A_1$-$B_1$, $A_2$-$B_2$

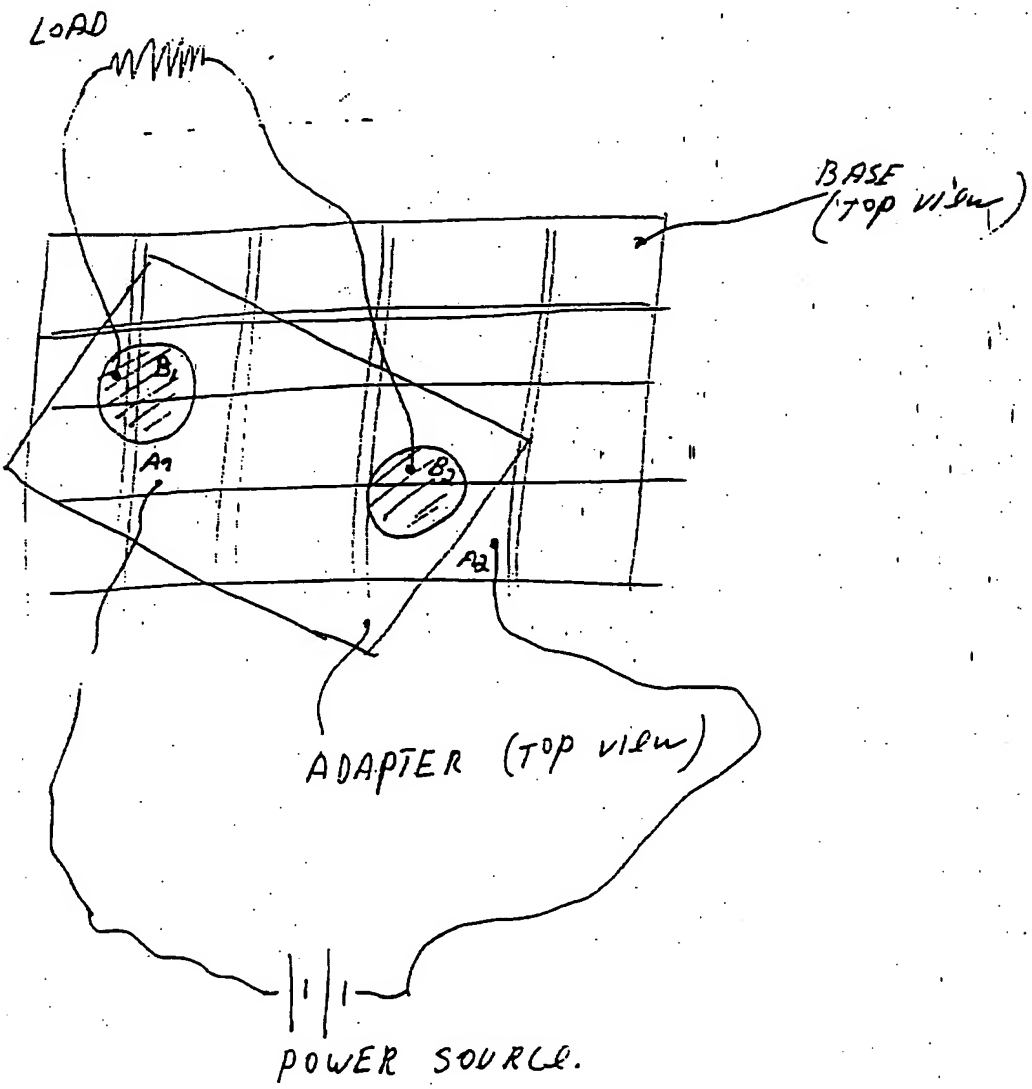


Figure 3:

FIGURE 3 - EXAMPLE 1.

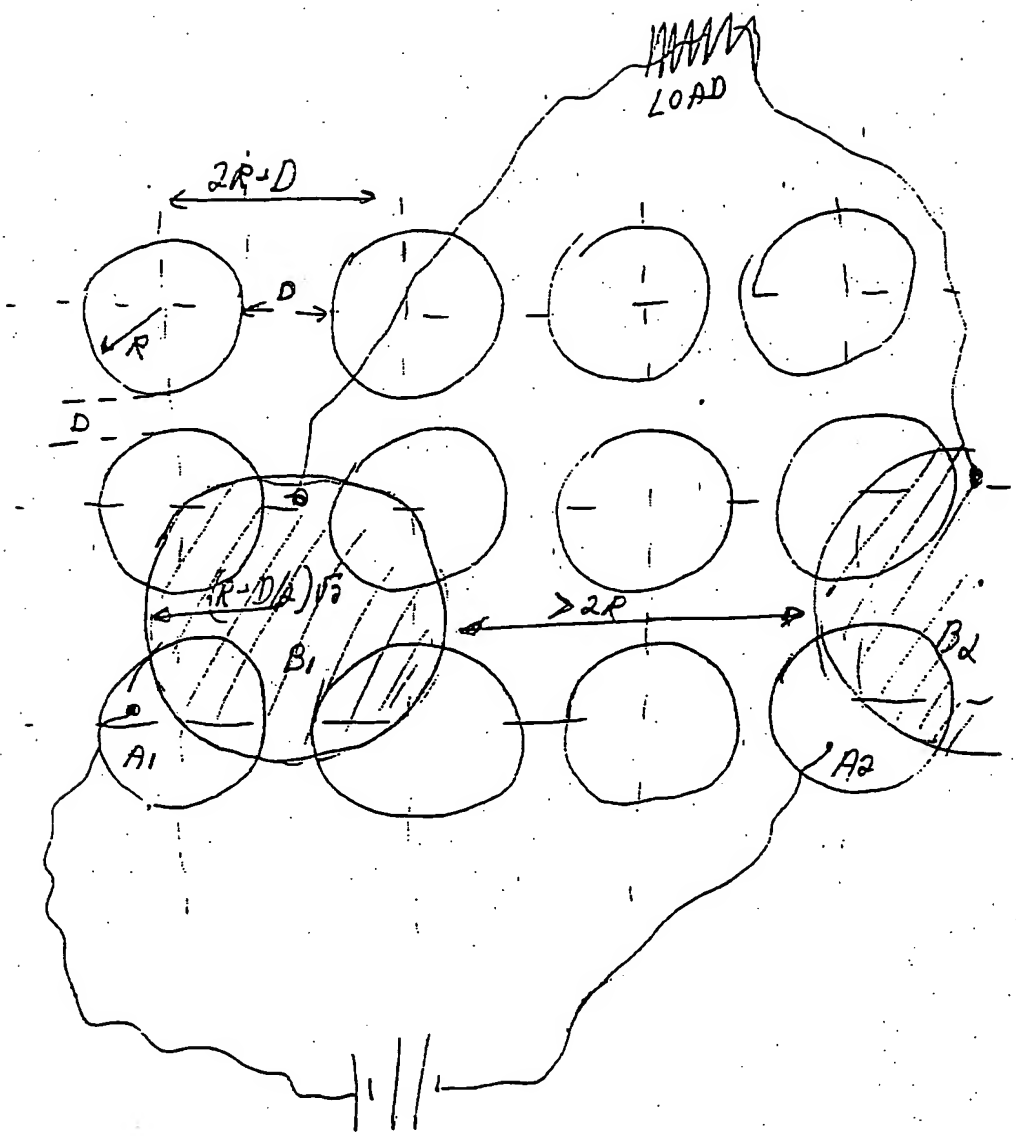
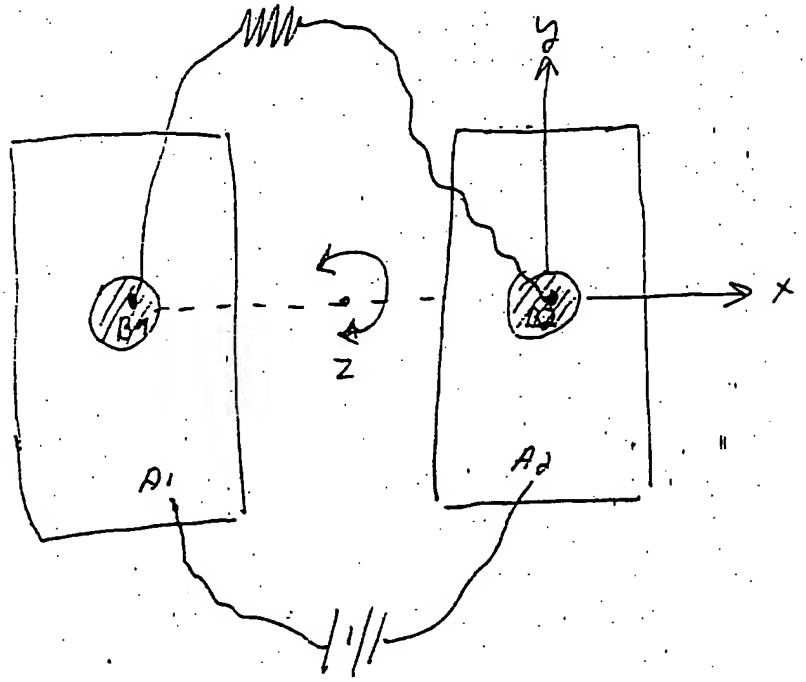
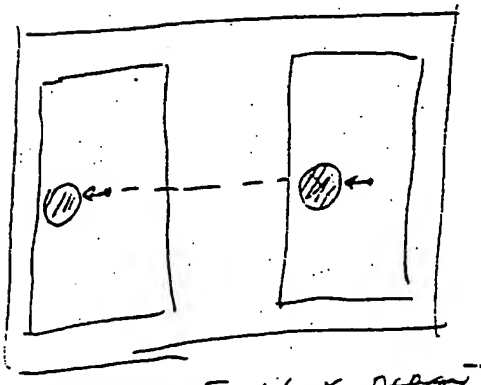


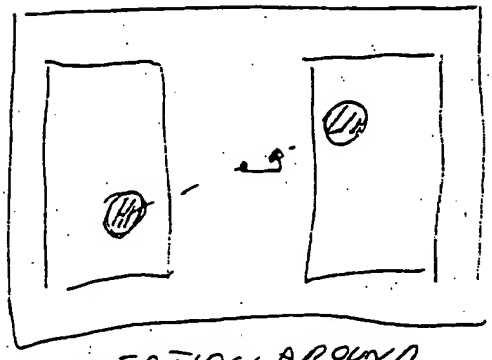
Figure 4:

FIGURE 4 - LIMITED RANGE EXAMPLE



MOVEMENT IN X AXIS



ROTATION AROUND Z AXIS